

Title: Liquid crystal beads constrained on thin cellulosic fibers: electric field induced microrotors and N-I transition

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Abstract: We directly visualize the response of nematic liquid crystal drops of toroidal topology threaded in cellulosic fibers, suspended in air, to an AC electric field and at different temperatures over the N-I transition. This new liquid crystal system can exhibit non-trivial point defects, which can be energetically unstable against expanding into ring defects depending on the fiber constraining geometries. The director anchoring tangentially near the fiber surface and homeotropically at the air interface makes a hybrid shell distribution that in turn causes a ring disclination line around the main axis of the fiber at the center of the droplet. Upon application of an electric field, E, the disclination ring first expands and moves along the fiber main axis, followed by the appearance of a stable "spherical particle" object orbiting around the fiber at the center of the liquid crystal drop. The rotation speed of this particle was found to vary linearly with the applied voltage. This constrained liquid crystal geometry seems to meet the essential requirements in which soliton-like deformations can develop and exhibit stable orbiting in three dimensions upon application of an external electric field. On changing the temperature the system remains stable and allows the study of the defect evolution near the nematic-isotropic transition, showing qualitatively different behaviour on cooling and heating processes. The necklaces of such liquid crystal drops constitute excellent systems for the study of topological defects and their evolution and open new perspectives for application in microelectronics and photonics.

KeyWords Plus: Structural Transformations; Alignment Layers; Light-Scattering; Point-Defects; Nematic Drops; Films; Microdroplets; Elasticity

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